

PATENT COOPERATION TREATY

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INTERNATIONAL SEARCHING AUTHORITY

To:

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PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/RU2005/000561

International filing date (day/month/year)
14.11.2005

Priority date (day/month/year)

International Patent Classification (IPC) or both national classification and IPC
INV. G06T7/00 G06F11/36

Applicant
INTEL CORPORATION

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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PCT/ISA/210

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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/RU2005/000561

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - ☒ the international application in the language in which it was filed
 - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ on paper
 - ☐ in electronic form
 - c. time of filing/furnishing:
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in electronic form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/RU2005/000561

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-21 (but see Item V)
	No: Claims	
Inventive step (IS)	Yes: Claims	1-21
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-21
	No: Claims	

2. Citations and explanations

see separate sheet

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

1 Reference is made to the following documents of the international search report:

D1: XP-2 397 141, Eggplant Version 3.1 Tutorial, 3 June 2005

D2: XP-002388052, David Herron's Blog, "Accessibility for test automation"

D3: US-A-5 335 342, (Tiburon Systems Inc.), 1994-08-02

2 The following clarity problems have to be addressed first:

2.1 Claims 1,8,15 have been drafted as separate independent claims apparently relating to very similar subject-matter but differing from each other widely with regard to the definition of the subject-matter for which protection is sought and, most notably, in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack clarity when read in their entirety. In order to overcome this objection it would be necessary to closely harmonise the wording of the independent claims.

2.2 The term contour arises first in claims 5,12,19 and thus lacks antecedent support in claims 6,7,13,14,20,21. The category of claim 21 is "system".

2.3 The following expressions of claims 1,8,15 are unclear/vague/have no commonly recognised/unique technical meaning and thus have to be clarified in the claims based on the definitions given in the description:

1. "structural content filtration" - what is "structural content"/"content" of what ?
2. "active object" - what is "active" ? "object" of what ? is it the "object to be searched for" ?
3. "recorded image generated by a graphical user interface" - what is the role of the GUI exactly ? what is the meaning of "recorded" here ?
4. "playback image" - what is played back ? why is there an "image" ?
5. "subset" - why "sub"-set ? (lack of antecedent support)
6. what steps are automatic/what steps require user input ?

7. how do the claimed steps relate to the wanted automated control of the application software ?

In order to further explicate the above objection the following exemplary wording of claims 1,8,15 - which would overcome the objection - is presented: (example for claim 1, corresponding examples for claims 8,15 implied):

"An automated computer implemented method of structural content filtration to reduce the number of hypotheses for the location of an active object of a graphical user interface GUI in an image of said GUI in order to automatically control, based on user activity recorded during a recording phase, execution of the application program having said GUI during a playback phase, said method comprising:

- recording an image depicting GUI objects, including said active object, displayed by said application program during said interactive recording phase,*
- transforming the recorded image and a corresponding playback image of said GUI captured during said playback phase;*
- determining a sub-image from the recorded image which corresponds to said active object to be searched for in the transformed playback image;*
- determining a set of points on the transformed playback image which have appropriate values for matching the sub-image; and*
- filtering location hypotheses on the playback image which are more than a selected distance from any point in said set in order to identify the GUI object to be activated next to continue playback."*

- 2.4 Without the clarification in the last sentence the subject matter of claims 1,8,15 could also be misunderstood and accidentally read on comparing areas of the test screen shots to the playback screens hot areas in order to identify the differences due to software bugs (cf. D3, claim 1).
- 2.5 For the following the subject matter of claims 1,8,15 will be interpreted as if already clarified.
- 3 The claimed subject matter lacks an inventive step for the following reasons:

LACK OF INVENTIVE STEP W.R.T. HUMAN BEHAVIOUR:

- 3.1 The claimed subject matter of claims 1,8 and 15 can be compared with the operation of a human operator performing manual testing sessions of developed computer applications. Indeed this is explicitly admitted on pg. 2 line 30-pg. 3 line 4. Claimed subject matter amounting to nothing more than the mere idea of automating human behaviour does not involve any inventive activity, in particular:
- 3.2 Considering that previous research in the area of image recognition has been strongly inspired by human vision and that existing program analysis systems also already use image recognition techniques (see section "Description" on pg. 1 of the present application), it was an obvious aim to design a computer-implemented method/system for GUI testing by searching for an active GUI object by automating steps which a human being would perform in a similar situation (replacing the human tester by an equivalent machine).
- 3.3 The closest prior art is taken to be the way a human would memorize and re-execute graphical user input in order to control a computer program.

Assume, for example, that a person is taught a sequence of commands on one screen e.g. in a course or through a demo/tutorial, or upon being instructed on how to carry out a manual software test. Most persons will visually memorize the appearance of the GUI and the appearance of the buttons which have to be clicked. When it comes to replay this sequence of events, e.g. at the own computer, the person will try to match the memorized pictures with the GUI as it currently appears in order to re-click the buttons in the right order.

Note that the person's computer might well have a screen of different size/colour scheme etc. and thus the memorized picture and the currently seen picture would have to be mentally transformed to take account of these trivial differences in appearance.

Note also that the person would mentally "determine a set of points", namely those points in the current screen image which match the appearance of the memorized

active button sub-image of the screens hot image.

Finally, note that filtering hypotheses arises naturally and frequently in human and in machine recognition. For example, if the person should have partially forgotten which button was the right one during training then the overall layout and its distances constitute a common visual cue for hypotheses filtering. For example: "The button was in the upper left during training (recording) so I expect it to be there again and I wont click on one of the more distant buttons during actual working sessions (playback)".

- 3.4 Thus, the features of claim 1 (and accordingly also those of claims 8 and 15) are merely those which a skilled person would make a machine perform in order to correspond to the way a human being would accomplish the same task of "extracting" and re-finding "objects" within his field of vision. Thus, the claimed method amounts to nothing more than the mere idea of automating human behaviour and hence does not involve an inventive step (Article 56 EPC).
- 3.5 The above analysis also extends to the subject matter of dependent claims 2-7,9-14,16-21: it is a well documented fact of perception research that human beings also use the visual outline of objects when recognising them: hence the corresponding use of contours (edges) is trivial. So is the transforming into "black/white" as most human beings do not memorise the colours anyway, and, moreover, not disregarding color would evidently render the approach non robust w.r.t. changes in user selected color schemes. Finally, "black/white" renderings are most common during OCR which would also be a standard algorithm most usefully employed on the text parts of the subimages.

LACK OF INVENTIVE STEP W.R.T. PRIOR ART DOCUMENTS:

- 3.6 In the present case, it is also possible to alternatively argue as follows:
- 3.7 Prior art document D1 ("eggplantTM") teaches capturing GUI image areas and saving them as templates during recording. During playback these image areas are searched in the playback screen image, and the corresponding active objects of the

GUI are activated if a match between a region in the playback image and the recorded captured template can be found (see, for example, "The Finished Script" on pg 16). Alternatively, one could start from D2 ("post by robogeed on July 25, 2005 at 7:38 AM") or also from D3 (claim 8 and col. 5 lines 25-51) as closest prior art.

- 3.8 Hence, the closest prior art might be interpreted as differing from the subject matter of claims 1,8,15 basically in that it does not teach filtering of hypotheses on the playback image which are more than a selected distance from any of the subset of points.
- 3.9 The technical problem would thus be: improve the template matching used in D1.
- 3.10 Recognising this problem does not constitute by itself an inventive step. Correct template matching being crucial for the success of D1, it is evident that making it as robust as possible is highly desirable.
- 3.11 The solution recited in claims 1,8,15 also does not involve an inventive step. Note that the close similarity of the task at hand (re-locating sub-regions of a previous image in a later subsequent image) to the general problems encountered in image registration and in tracking image regions is palpable. Adding a step of filtering among multiple hypotheses based on further cues is a standard technique in computer vision in general, and in particular so in tracking and in image registration. Moreover, distances are also commonly employed for that purpose, i.e. to eliminate wrong template matches in image registration and tracking. Hence, in the present context, using the distances among the objects of the GUI for hypothesis filtering constitutes an obvious solution that is obtained through entirely routine-reasoning within the framework of the normal progress of technology.